

JC10 Rec'd PCT/PTO 01 APR 2002

FORM PTO-1390 (REV. 9-2001)		U S DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE		ATTORNEY'S DOCKET NUMBER <b>35875/GM/1p</b>
<b>TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371</b>				U.S. APPLICATION NO (If known, see 37 CFR 1.5 <b>still 10 known 089607</b>
INTERNATIONAL APPLICATION NO. <b>PCT/EP00/09755</b>	INTERNATIONAL FILING DATE <b>4 OCTOBER 2000</b>		PRIORITY DATE CLAIMED <b>8 OCTOBER 1999</b>	
TITLE OF INVENTION <b>ELECTRIC POLE FOR LOW-VOLTAGE POWER CIRCUIT BREAKER</b>				
APPLICANT(S) FOR DO/EO/US <b>Lucio AZZOLA - Eligio ZANCHI</b>				
Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:				
<p>1. <input checked="" type="checkbox"/> This is a <b>FIRST</b> submission of items concerning a filing under 35 U.S.C. 371.</p> <p>2. <input type="checkbox"/> This is a <b>SECOND</b> or <b>SUBSEQUENT</b> submission of items concerning a filing under 35 U.S.C. 371.</p> <p>3. <input checked="" type="checkbox"/> This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include items (5), (6), (9) and (21) indicated below.</p> <p>4. <input checked="" type="checkbox"/> The US has been elected by the expiration of 19 months from the priority date (Article 31).</p> <p>5. <input checked="" type="checkbox"/> A copy of the International Application as filed (35 U.S.C. 371(c)(2))</p> <ul style="list-style-type: none"> <li>a. <input checked="" type="checkbox"/> is attached hereto (required only if not communicated by the International Bureau).</li> <li>b. <input checked="" type="checkbox"/> has been communicated by the International Bureau.</li> <li>c. <input type="checkbox"/> is not required, as the application was filed in the United States Receiving Office (RO/US).</li> </ul> <p>6. <input type="checkbox"/> An English language translation of the International Application as filed (35 U.S.C. 371(c)(2))</p> <ul style="list-style-type: none"> <li>a. <input type="checkbox"/> is attached hereto.</li> <li>b. <input type="checkbox"/> has been previously submitted under 35 U.S.C. 154(d)(4).</li> </ul> <p>7. <input checked="" type="checkbox"/> Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))</p> <ul style="list-style-type: none"> <li>a. <input type="checkbox"/> are attached hereto (required only if not communicated by the International Bureau).</li> <li>b. <input type="checkbox"/> have been communicated by the International Bureau.</li> <li>c. <input type="checkbox"/> have not been made; however, the time limit for making such amendments has NOT expired.</li> <li>d. <input checked="" type="checkbox"/> have not been made and will not be made.</li> </ul> <p>8. <input type="checkbox"/> An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).</p> <p>9. <input checked="" type="checkbox"/> An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).</p> <p>10. <input type="checkbox"/> An English language translation of the annexes of the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).</p>				
<p><b>Items 11 to 20 below concern document(s) or information included:</b></p> <p>11. <input checked="" type="checkbox"/> An Information Disclosure Statement under 37 CFR 1.97 and 1.98.</p> <p>12. <input checked="" type="checkbox"/> An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.</p> <p>13. <input checked="" type="checkbox"/> A <b>FIRST</b> preliminary amendment.</p> <p>14. <input type="checkbox"/> A <b>SECOND</b> or <b>SUBSEQUENT</b> preliminary amendment.</p> <p>15. <input type="checkbox"/> A substitute specification.</p> <p>16. <input type="checkbox"/> A change of power of attorney and/or address letter.</p> <p>17. <input type="checkbox"/> A computer-readable form of the sequence listing in accordance with PCT Rule 13ter.2 and 35 U.S.C. 1.821 - 1.825.</p> <p>18. <input type="checkbox"/> A second copy of the published international application under 35 U.S.C. 154(d)(4).</p> <p>19. <input type="checkbox"/> A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4).</p> <p>20. <input checked="" type="checkbox"/> Other items or information: <b>redrafted claims 9 to 16 for entering the preliminary amendment</b></p>				

10/089607 U.S. APPLICATION NO. (if known) 37 CFR 1.1 still unknown		INTERNATIONAL APPLICATION NO. PCT/EP00/09755	ATTORNEY'S DOCKET NUMBER 35875/GM/1p																								
<p>21. <input checked="" type="checkbox"/> The following fees are submitted:</p> <p><b>BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)):</b></p> <p>Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO ..... \$1040.00</p> <p>International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO ..... \$890.00</p> <p>International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO ..... \$740.00</p> <p>International preliminary examination fee (37 CFR 1.482) paid to USPTO but all claims did not satisfy provisions of PCT Article 33(1)-(4) ..... \$710.00</p> <p>International preliminary examination fee (37 CFR 1.482) paid to USPTO and all claims satisfied provisions of PCT Article 33(1)-(4) ..... \$100.00</p>		CALCULATIONS PTO USE ONLY																									
<b>ENTER APPROPRIATE BASIC FEE AMOUNT =</b>		<b>\$ 890.=</b>																									
<p>Surcharge of \$130.00 for furnishing the oath or declaration later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(e)).</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>CLAIMS</th> <th>NUMBER FILED</th> <th>NUMBER EXTRA</th> <th>RATE</th> <th>\$</th> </tr> </thead> <tbody> <tr> <td>Total claims</td> <td>8 - 20 =</td> <td></td> <td>x \$18.00</td> <td>\$</td> </tr> <tr> <td>Independent claims</td> <td>2 - 3 =</td> <td></td> <td>x \$84.00</td> <td>\$</td> </tr> <tr> <td colspan="2">MULTIPLE DEPENDENT CLAIM(S) (if applicable)</td> <td></td> <td>+ \$280.00</td> <td>\$</td> </tr> <tr> <td colspan="2" style="text-align: right;"><b>TOTAL OF ABOVE CALCULATIONS =</b></td> <td style="text-align: center;"><b>\$ 890.=</b></td> <td></td> </tr> </tbody> </table>		CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE	\$	Total claims	8 - 20 =		x \$18.00	\$	Independent claims	2 - 3 =		x \$84.00	\$	MULTIPLE DEPENDENT CLAIM(S) (if applicable)			+ \$280.00	\$	<b>TOTAL OF ABOVE CALCULATIONS =</b>		<b>\$ 890.=</b>		<input type="checkbox"/> Applicant claims small entity status. See 37 CFR 1.27. The fees indicated above are reduced by 1/2.	+
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<p>a. <input type="checkbox"/> A check in the amount of \$ _____ to cover the above fees is enclosed.</p> <p>b. <input checked="" type="checkbox"/> Please charge my Deposit Account No. <u>13-3860</u> in the amount of \$ <u>930.=</u> to cover the above fees. A duplicate copy of this sheet is enclosed.</p> <p>c. <input checked="" type="checkbox"/> The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. <u>13-3860</u>. A duplicate copy of this sheet is enclosed.</p> <p>d. <input type="checkbox"/> Fees are to be charged to a credit card. <b>WARNING:</b> Information on this form may become public. <b>Credit card information should not be included on this form.</b> Provide credit card information and authorization on PTO-2038.</p>																											
<p><b>NOTE:</b> Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137 (a) or (b)) must be filed and granted to restore the application to pending status.</p>																											
<p>SEND ALL CORRESPONDENCE TO:</p> <p><b>MODIANO &amp; ASSOCIATI</b>  <b>Via Meravigli, 16</b>  <b>20123 MILANO - ITALY</b>  <b>EUROPE</b>  <b>Tel.: (003902) 85.90.77.77</b>  <b>Milano, Italy - March 28, 2002</b></p>		 <p>SIGNATURE  <b>Guido MODIANO</b></p> <p>NAME  <b>19,928</b></p> <p>REGISTRATION NUMBER</p>																									

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Docket No.35875/GM/lp

## IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Assignors : Lucio AZZOLA – Eligio ZANCHI  
Assignee : ABB SERVICE S.R.L.  
Ser. No. : still unknown  
Filed : still unknown  
For : "ELECTRIC POLE FOR LOW-VOLTAGE POWER  
CIRCUIT BREAKER"  
A.U. : still unknown  
Examiner : still unknown

Hon.

The Commissioner of Patents and Trademarks

**BOX P.C.T.**

Washington D.C. 20231 - U.S.A.

**PRELIMINARY AMENDMENT**

Sir,

please enter the following preliminary amendment in the above-identified Application:

substitute the original claims 1 to 8 with the enclosed redrafted claims 9 to 16.

It is to be noted that the newly submitted claims 9 to 16 do not comprise any new matter but merely more clearly define Applicants' originally disclosed invention.

Respectfully submitted



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Guido MODIANO

(Reg. No. 19,928)

Agent for the Applicants

Via Meravigli, 16

20123 MILAN – ITALY

Tel.: +39-02-85907777

Milan, Italy – March 28, 2002

Encls.: a.a.

**WHAT IS CLAIMED IS:**

9. An electric pole for a low-voltage power circuit breaker, comprising:
  - a fixed contact and a movable contact which can be mutually coupled/uncoupled;
  - 5 -- at least two conducting elements, suitable to electrically connect said movable contact to a power supply grid, said conducting elements being arranged so that the electric currents flowing through them are equally orientated; and
  - means for mechanically supporting and actuating said movable contact;
10. further comprising at least one insulating element which is interposed between said conducting elements and contrasts, by friction with said conducting elements, electrodynamic repulsion forces that are generated between said fixed contact and said movable contact during opening in short-circuit operating conditions.
15. 10. The electric pole according to claim 9, wherein said means for mechanically supporting and actuating said movable contact comprise a contact-supporting operating shaft made of insulating material.
11. The electric pole according to claim 10, wherein said insulating element is operatively connected to said operating shaft.
20. 12. The electric pole according to claim 11, wherein said insulating element and said operating shaft are realized monolithically.
13. The electric pole according to claim 9, wherein said insulating element comprises a body made of plastic material which, seen laterally, presents two walls having a curved profile and being suitable to operatively interact with said at least two conducting elements.
25. 14. The electric pole according to claim 9, wherein said at least two conducting elements are constituted by a pair of flexible metallic braids which are parallel-connected to each other.
15. The electric pole according to claim 14, wherein said flexible metallic braids comprise, at each end, means for connection respectively to said

movable contact and to said power supply grid.

16. A low-voltage power circuit breaker, comprising at least one electric pole according to claim 9.

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BACKGROUND OF THE INVENTION

The present invention relates to an electric pole for a low-voltage power circuit breaker having improved characteristics.

More specifically, the expression "low-voltage power circuit breaker" is used to designate a circuit breaker which is generally used in applications, e.g. industrial systems, characterized by operating voltages of less than 1000 volts and by electric currents, typically alternate currents, of relatively high nominal value, (from a few hundred to several thousand amperes), which accordingly produce relatively high power levels.

It is known that power circuit breakers, comprising one or more electric poles, are normally designated to ensure the electric current required by the various users, at the same time performing connection and disconnection of the load or protecting the load from abnormal events, due for example to overloads or to a short circuit, by automatically opening the circuit, or disconnecting the protected circuit by opening appropriately provided electric contacts in order to achieve complete isolation of the load with respect to the power supply grid.

Currently there are many embodiments of low-voltage power circuit breakers, according to the nominal current considered.

In general, however, for each electric pole the interruption of the current, be it a nominal, overload or short-circuit current, occurs by virtue of the separation of a movable contact and of a fixed contact.

An example of a contact arrangement for a low-voltage circuit breaker is described in the European Patent EP 0219449.

The typical structure of an electric pole for a low-voltage power circuit breaker is described with reference to Figure 1. Said pole comprises a fixed contact 1 and a movable contact 2 which can be mutually coupled/uncoupled. The movable contact 2 is connected and arranged on a contact supporting shaft 4 which is generally made of insulating material and acts as a mechanical support and/or transmits the motion to the movable

contact. In order to maintain electrical continuity while allowing the motion of the movable contact 2, a flexible conductor 3 is generally used which has the only task of ensuring the electrical connection between the movable contact 2 and a power supply grid, not shown in Figure 1.

5 The movable contact 2, the flexible conductor 3 and the contact supporting shaft 4 are shown in greater detail in Figure 2. In this case, the flexible conductor 3 is constituted by two flexible metal braids which are accommodated contiguously in a cavity of the contact supporting shaft. At the ends of the metal braids there are a flange 7 and a pivot 8, which are used 10 respectively for connection to the power supply grid and to the movable contact.

15 In the operating condition for opening at nominal current, following an opening command, the movable contact 2 is moved at a specific speed by the contact supporting shaft 4, which is in turn actuated by an actuation mechanism, not shown in Figures 1 and 2.

20 In the operating condition for opening at short-circuit current, typically before the opening intervention performed by the actuation mechanism, separation of the electric contacts occurs due to the electrodynamic repulsion forces that arise between the movable contact and the fixed contact. For high short-circuit currents, such as those that affect low-voltage power circuit 25 breakers (tens of kiloamperes), these electrodynamic repulsion forces reach values which impart a very high end-stroke velocity to the movable contact.

25 Due to the very high velocity at the end-stroke, it is necessary to provide, in order to stop the movable contact 2, appropriate arrester devices, for example an abutment plate 5, as shown in Figure 1, and to give sufficiently sturdy dimensions to the entire kinematic opening system movable contact 2 and contact supporting shaft 4, so that it can withstand the intense stresses caused by the stroke end impact of the movable contact 2. To avoid this occurrence, it is necessary to provide the entire kinematic opening system so 30 that intervention occurs in a relatively short time, particularly before the

movable contact reaches the end of its stroke.

These design constraints of course entail a considerable increase in the manufacturing times and costs of the circuit breaker.

Furthermore, again due to the high velocity at the end-stroke, the movable contact might not stop at the abutment plate 5 but might bounce on it, coupling to the fixed contact again. This occurrence would be critical, since it would entail an unwanted closure of the contacts in the presence of fault conditions.

#### SUMMARY OF THE INVENTION

10 The aim of the present invention is to provide an electric pole for a low-voltage power circuit breaker which allows to limit to relatively modest values the end-stroke velocity of the movable contact during opening in short-circuit operating conditions.

15 Within the scope of this aim, an object of the present invention is to provide an electric pole for a low-voltage power circuit breaker in which it is possible to ensure the arresting of the movable contact during opening in short-circuit operating conditions without adopting particular arrester devices.

20 Another object of the present invention is to provide an electric pole for a low-voltage power circuit breaker which ensures the possibility to avoid unwanted reclosures of the electric contacts after opening in short-circuit operating conditions.

25 Another object of the present invention is to provide an electric pole for a low-voltage power circuit breaker which ensures the possibility to limit the required intervention speed of the kinematic opening system.

Another object of the present invention is to provide an electric pole for a low-voltage power circuit breaker which is highly reliable, simple to manufacture and at low cost.

30 This aim, these objects and others which will become apparent hereinafter are achieved by an electric pole for a low-voltage power circuit breaker,

comprising:

-- a fixed contact and a movable contact which can be mutually coupled/uncoupled;

5 -- at least two conducting elements, suitable to electrically connect said movable contact to a power supply grid, said conducting elements being arranged so that the electric currents flowing through them are equally orientated; and

-- means for mechanically supporting and actuating said movable contact;

10 The electric pole according to the invention is characterized in that it comprise at least one insulating element which is interposed between said conducting elements and contrasts, by friction with said conducting elements, electrodynamic repulsion forces that are generated between said fixed contact and said movable contact during opening in short-circuit operating conditions.

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#### BRIEF DESCRIPTION OF THE DRAWINGS

Further characteristics and advantages of the invention will become apparent from the description of some preferred but non-limitative embodiments of an electric pole for a low-voltage power circuit breaker according to the invention, illustrated only by way of non-limitative example 20 with the aid of the accompanying drawings, wherein:

Figure 1 is a schematic view of an electric pole for low-voltage power circuit breakers, having a known structure;

Figure 2 is a perspective view of a constructive detail of the electric pole of Figure 1;

25 Figure 3 is a schematic view of the structure of a first embodiment of the electric pole according to the invention;

Figures 4a and 4b are two different perspective views of a constructive detail of the embodiment of the electric pole according to the invention, shown in Figure 3.

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#### DESCRIPTION OF THE PREFERRED EMBODIMENTS

With reference to Figure 3, the electric pole according to the invention has a fixed contact, not shown in Figure, and a movable contact 10 which can be mutually coupled/uncoupled, and two or more conducting elements 11 for electrically connecting the movable contact 10 to a power supply grid, 5 also not shown in Figure 3. A particular characteristic of the conducting elements 11 is the fact that they are arranged so that the electric currents flowing through them are equally orientated. For example, according to a preferred embodiment shown in Figure 3, the conducting elements 11 are constituted by a pair of flexible metallic braids which are connected in 10 parallel to each other. This solution ensures that the flow of electric current occurs in the same direction in both conducting elements 11, for example in the direction indicated by the arrow 16.

Other embodiments are of course possible which may foresee, for example, the use of a larger number of conducting elements, provided that 15 they are always arranged so as to be interested by equally orientated currents. Advantageously, the flexible metallic braids 11 of Figure 3 comprise, at each end, means for providing connection respectively to the movable contact 10 and to the power supply grid. In the embodiment of Figure 3, the means for connecting to the power grid are constituted by a connecting flange 14.

20 The electric pole according to the invention further comprises means 12 which are suitable to mechanically support the movable contact 10 and to transmit motion thereto; in particular, said means 12 comprise a contact supporting shaft 12 which is made of insulating material.

25 The electric pole according to the invention is characterized in that it comprises one or more insulating elements, designated by the reference numeral 13 in Figure 3, which are interposed between the conducting elements 11.

For example, in the embodiment of Figure 3 there is a single insulating 30 element 13 which is arranged between the two parallel braids 11 and is operatively connected to the insulating shaft 12.

The essential function performed by the insulating element 13 is to contrast, by friction with the conducting elements 11, the electrodynamic repulsion forces generated between the fixed contact and the movable contact during opening in short-circuit operating conditions.

5 Since the conducting elements 11 are crossed by equally orientated currents, an electrodynamic attraction force, schematically indicated by the arrows 17 in Figure 3, occurs between them. In short-circuit operating conditions, when the currents that flow through the conductors 11 reach high levels, the conducting elements 11 are attracted against the insulating element 13 interposed between them. The friction force that occurs between the conductors 11 and the element 13 contrasts the movement of the contact supporting shaft 12, rigidly coupled to the movable contact 10. In this manner, the friction force absorbs part of the energy with which the movable contact 2 separates from the fixed contact. The end-stroke velocity of the movable contact 10 is thus reduced so that it is below relatively modest limits. As the friction force between the insulating element 13 and the conductors 11 is directly proportional to the current that flows through the conductors, the force that contrasts the motion of the movable contact therefore becomes considerable for high current values, as in the operating conditions for opening at short-circuit current.

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On the other end, in operating conditions for opening at nominal current, in view of the very low current values, the friction force does not assume significant values, thus not affecting in any way the opening movement.

A preferred embodiment of the contact supporting shaft 12 and of the insulating element 13, particularly suitable for use in three-pole circuit breakers, are described with reference to Figures 4a and 4b.

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In this case, three insulating elements 13, each of which corresponds to a movable contact (not shown) which belongs to a corresponding pole, are fixed to the contact supporting shaft 12.

30 As illustrated, each insulating element 13 comprises a body which, seen

laterally, has two curved-shaped walls which are suitable to operatively interact with the corresponding conducting elements 11.

According to a solution which is structurally simple and functionally effective, the insulating elements are made of plastic material and are 5 realized monolithically with the operating shaft 12.

In particular, the insulating elements 13 can be directly obtained from the contact supporting shaft 14, for example by means of an injection-molding process.,

Alternatively, each insulating element 13 and the shaft 12 can be realized 10 in two different pieces, suitably connected to each other; furthermore, each insulating element 13 could be operatively connected to other elements of the pole.

In practice it has been found that the electric pole according to the invention fully achieves the intended aim and objects.

15 In particular, by giving appropriate dimensions to the insulating elements and to the conducting elements, it is possible to determine, with reasonable approximation, the end-stroke velocity of the movable contact even during the operating conditions for opening at short-circuit current. It is therefore possible to set the dimensions of the electric pole according to the invention 20 so that the end-stroke velocity is limited to a range of relatively small values, reducing the energy of the stroke limit impact and preventing the occurrence of unwanted reclosures of said contacts.

It is further possible to eliminate, or at least to significantly reduce, the 25 arresters of the movable contact, which are commonly adopted in known types of circuit breaker.

The reduced end-stroke velocity of the movable contact allows to reduce the required intervention speed of the opening kinematic mechanism, thus relaxing the design constraints.

Finally, it has been observed that the adoption of the insulating elements 30 does not entail in any way a significant increase in manufacturing costs,

since said elements can be obtained directly from the contact supporting shaft. On the contrary, the possibility to eliminate the arresters of the movable contact and the possibility to simplify the opening kinematic mechanism of the circuit breaker entail a simplification in the manufacture of  
5 the circuit breaker, together with higher operating reliability.

The electric pole for a low-voltage power circuit breaker thus conceived is susceptible of modifications and variations, all of which are within the scope of the inventive concept; all the details may furthermore be replaced with technically equivalent elements. In practice, the materials used, so long  
10 as they are compatible with the specific use, as well as the dimensions, may be any according to requirements and to the state of the art.

## CLAIMS

1. An electric pole for a low-voltage power circuit breaker, comprising:
  - a fixed contact and a movable contact (10) which can be mutually coupled/uncoupled;
  - at least two conducting elements (11), suitable to electrically connect said movable contact (10) to a power supply grid, said conducting elements (11) being arranged so that the electric currents flowing through them are equally orientated; and
  - means (12) for mechanically supporting and actuating said movable contact (10);characterized in that it comprises at least one insulating element (13) which is interposed between said conducting elements (11) and contrasts, by friction with said conducting elements (11), electrodynamic repulsion forces that are generated between said fixed contact and said movable contact (10) during opening in short-circuit operating conditions.
2. The electric pole according to claim 1, characterized in that said means (12) for mechanically supporting and actuating said movable contact (10) comprise a contact-supporting operating shaft (12) made of insulating material.
3. The electric pole according to claims 1 and 2, characterized in that said insulating element (13) is operatively connected to said operating shaft (12).
4. The electric pole according to claim 3, characterized in that said insulating element (13) and said operating shaft (12) are realized monolithically.
5. The electric pole according to one or more of the preceding claims characterized in that said insulating element (13) comprises a body made of plastic material which, seen laterally, presents two walls having a curved profile and being suitable to operatively interact with said

conducting elements (11).

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6. The electric pole according to one or more of the preceding claims, characterized in that said conducting elements (11) are constituted by a pair of flexible metallic braids (11) which are parallel-connected to each other.
7. The electric pole according to claim 6, characterized in that said flexible metallic braids (11) comprise, at each end, means for connection respectively to said movable contact (10) and to said power supply grid.
8. A low-voltage power circuit breaker, characterized in that it comprises at least one electric pole according to one or more of the preceding claims.

10

### ABSTRACT

An electric pole for a low-voltage power circuit breaker, comprising:

- a fixed contact and a movable contact which can be mutually coupled/uncoupled;
- 5 -- at least two conducting elements, suitable to electrically connect the movable contact to a power supply grid, the conducting elements being arranged so that the electric currents flowing through them are equally orientated;
- means for mechanically supporting and actuating the movable contact; and
- 10 -- at least one insulating element which is interposed between the conducting elements and is suitable to contrast, by friction with the conducting elements, electrodynamic repulsion forces that are generated between the fixed contact and the movable contact during opening in short-circuit operating conditions.

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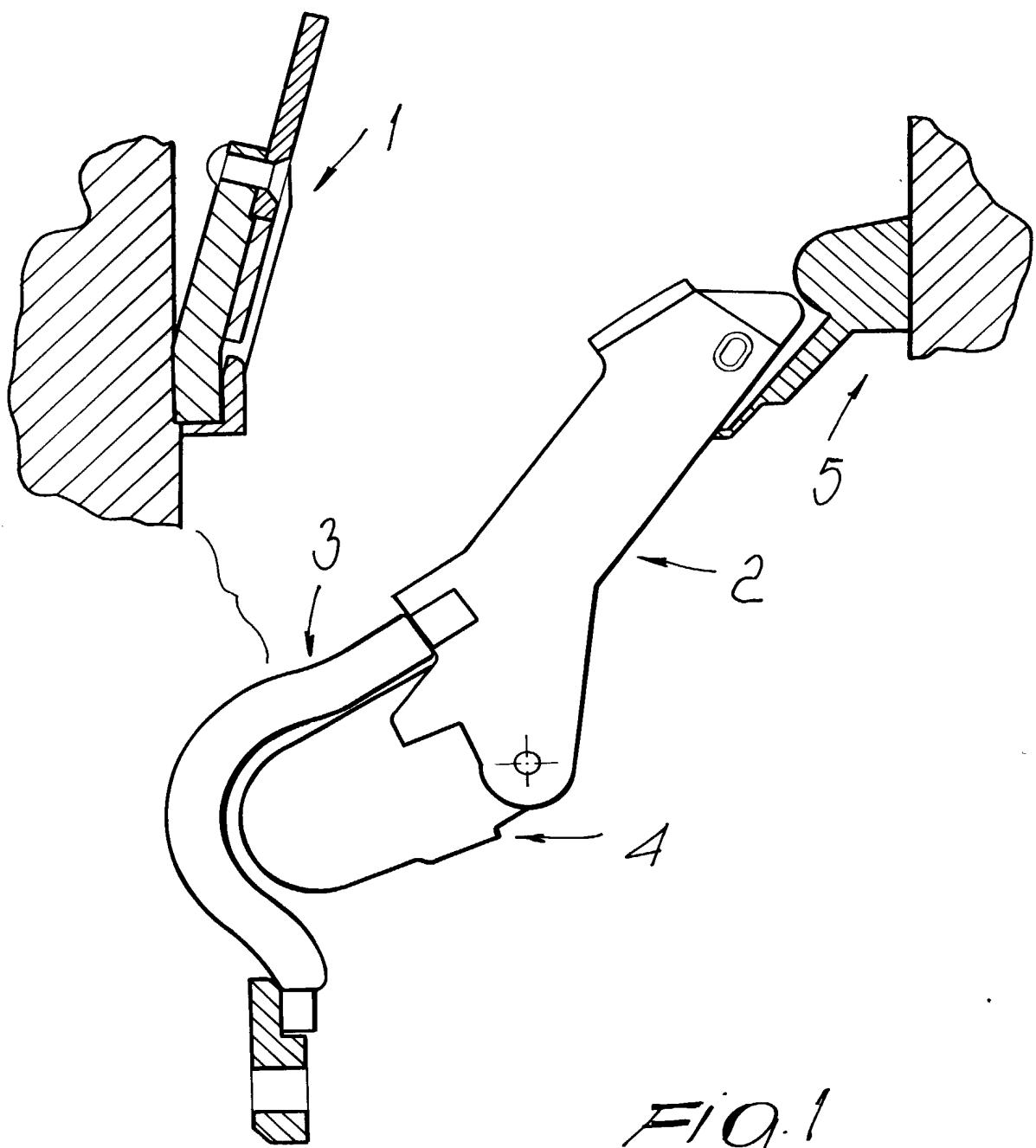


Fig. 1

3 400 000 000 000 000  
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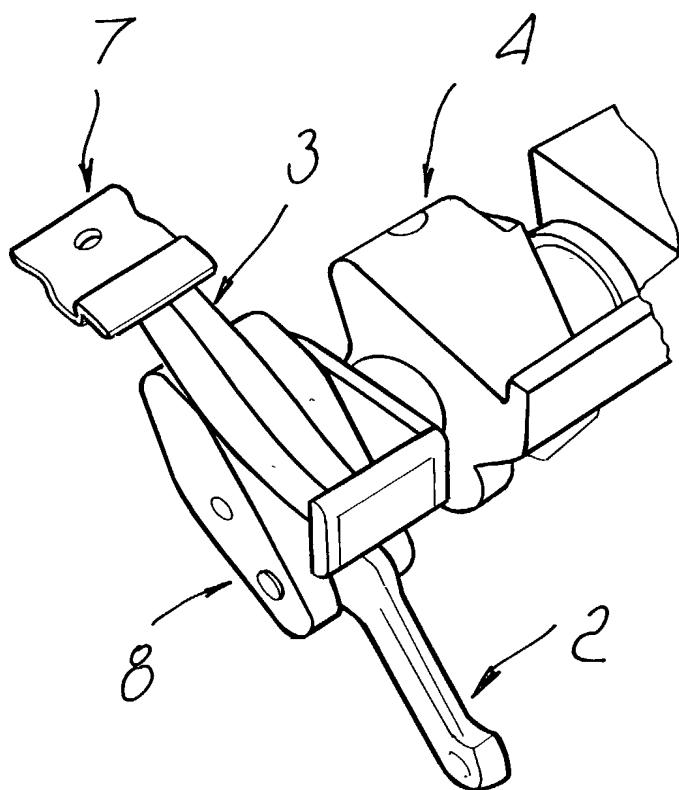


Fig. 2

3,630,836, 3,633,182  
10,089,607

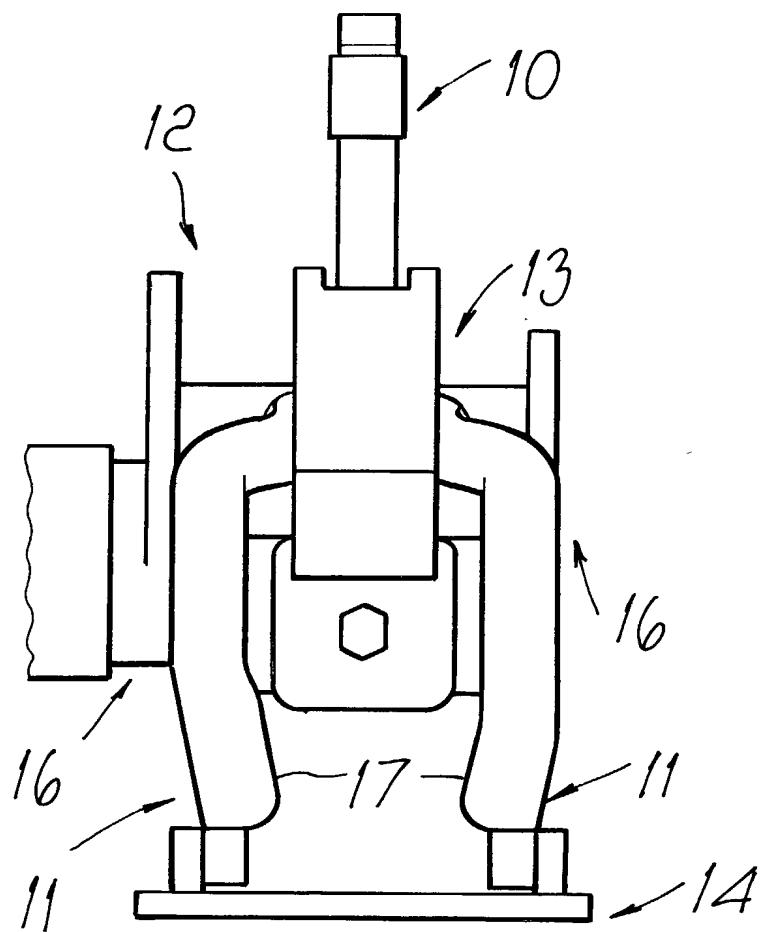


FIG. 3

1.000 0.993 0.986 0.979 0.972 0.965 0.958 0.951 0.944 0.937 0.930 0.923 0.916 0.909 0.902 0.895 0.888 0.881 0.874 0.867 0.860 0.853 0.846 0.839 0.832 0.825 0.818 0.811 0.804 0.797 0.790 0.783 0.776 0.769 0.762 0.755 0.748 0.741 0.734 0.727 0.720 0.713 0.706 0.700 0.693 0.686 0.679 0.672 0.665 0.658 0.651 0.644 0.637 0.630 0.623 0.616 0.609 0.602 0.595 0.588 0.581 0.574 0.567 0.560 0.553 0.546 0.539 0.532 0.525 0.518 0.511 0.504 0.497 0.490 0.483 0.476 0.469 0.462 0.455 0.448 0.441 0.434 0.427 0.420 0.413 0.406 0.400 0.393 0.386 0.379 0.372 0.365 0.358 0.351 0.344 0.337 0.330 0.323 0.316 0.309 0.302 0.295 0.288 0.281 0.274 0.267 0.260 0.253 0.246 0.239 0.232 0.225 0.218 0.211 0.204 0.200 0.196 0.192 0.188 0.184 0.180 0.176 0.172 0.168 0.164 0.160 0.156 0.152 0.148 0.144 0.140 0.136 0.132 0.128 0.124 0.120 0.116 0.112 0.108 0.104 0.100 0.096 0.092 0.088 0.084 0.080 0.076 0.072 0.068 0.064 0.060 0.056 0.052 0.048 0.044 0.040 0.036 0.032 0.028 0.024 0.020 0.016 0.012 0.008 0.004 0.000

10/08/607

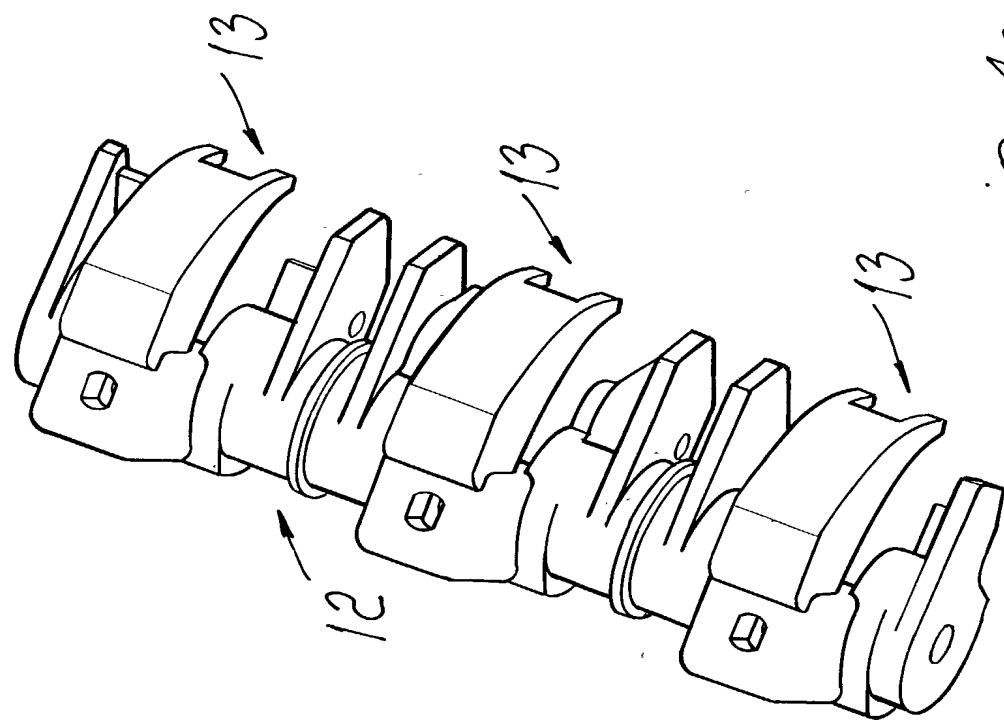


Fig. 4a

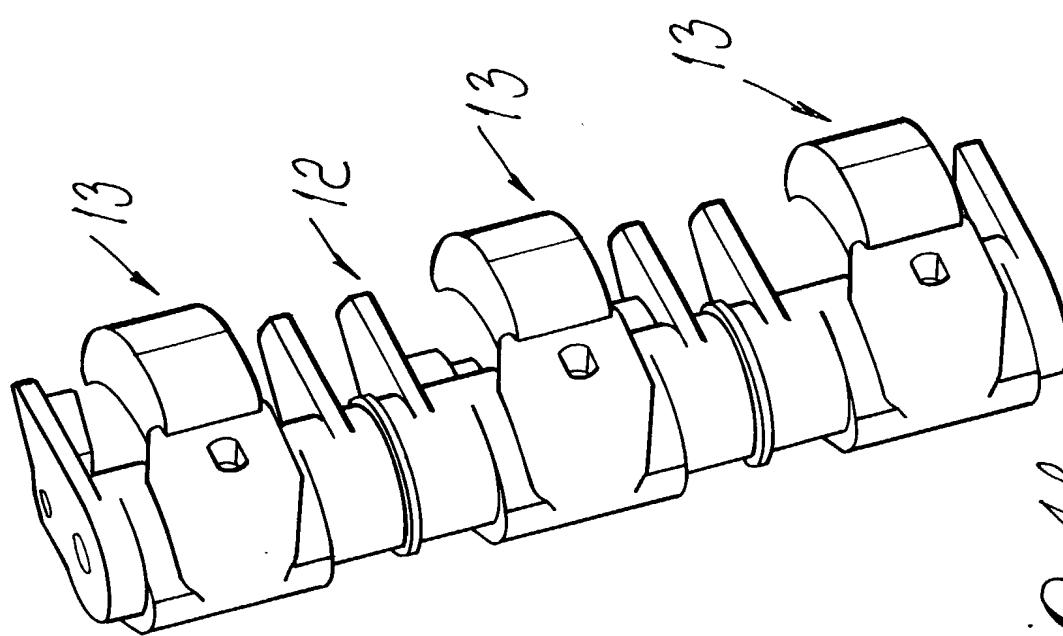


Fig. 4b

## PATENT

Attorney's Docket No. 35875/GM/1p

## COMBINED DECLARATION AND POWER OF ATTORNEY

(ORIGINAL, DESIGN, NATIONAL STAGE OF PCT, SUPPLEMENTAL, DIVISIONAL,  
CONTINUATION OR CIP)

As a below named inventor, I hereby declare that:

## TYPE OF DECLARATION

This declaration is of the following type: (check one applicable item below)

original  
 design

NOTE: If the declaration is for an International Application being filed as a divisional, continuation or continuation-in-part application do not check any of next two items and check appropriate one of last three items.

national stage of PCT  
 supplemental

NOTE: If one of the following 3 items apply then complete and also attach ADDED PAGES FOR DIVISIONAL, CONTINUATION OR CIP.

divisional  
 continuation  
 continuation-in-part (CIP)

## INVENTORSHIP IDENTIFICATION

WARNING: If the inventors are each not the inventors of all the claims an explanation of the facts, including the ownership of all the claims at the time the last claimed invention was made, should be submitted.

My residence, post office address and citizenship are as stated below next to my name, I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

TITLE OF INVENTION  
ELECTRIC POLE FOR LOW-VOLTAGE POWER CIRCUIT BREAKER

## SPECIFICATION IDENTIFICATION

the specification of which: (complete (a), (b) or (c))

(a)  is attached hereto.  
 (b)  was filed on \_\_\_\_\_ as  Serial No. \_\_\_\_\_  
 or  Express Mail No., as Serial No. not yet known \_\_\_\_\_  
 and was amended on \_\_\_\_\_ (if applicable).

NOTE: Amendments filed after the original papers are deposited with the PTO which contain new matter are not accorded a filing date by being referred to in the declaration. Accordingly, the amendments involved are those filed with the application papers or, in the case of a supplemental declaration, are those amendments claiming matter not encompassed in the original statement of invention or claims. See 37 CFR 1.67.

(Declaration and Power of Attorney [1-1]—page 1 of 1)

(c)  was described and claimed in PCT International Application No. PCT/EP00/09755 filed on OCTOBER 4, 2000 and as amended under PCT Article 19 on \_\_\_\_\_ (if any).

#### ACKNOWLEDGEMENT OF REVIEW OF PAPERS AND DUTY OF CANDOR

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations. § 1.56(a).

In compliance with this duty there is attached an information disclosure statement 37 CFR 1.97.

#### PRIORITY CLAIM

I hereby claim foreign priority benefits under Title 35, United States Code, § 119 of any foreign application(s) for patent or inventor's certificate or of any PCT international application(s) designating at least one country other than the United States of America listed below and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed.

(complete (d) or (e))

(d)  no such applications have been filed.

(e)  such applications have been filed as follows

*NOTE: Where item (c) is entered above and the International Application which designated the U.S. claimed priority check item (e), enter the details below and make the priority claim.*

#### EARLIEST FOREIGN APPLICATION(S), IF ANY FILED WITHIN 12 MONTHS (6 MONTHS FOR DESIGN) PRIOR TO THIS U.S. APPLICATION

COUNTRY	APPLICATION NUMBER	DATE OF FILING (month, day, year)	PRIORITY CLAIMED UNDER 37 USC 119
ITALY	MI99A002114	8 OCTOBER 1999	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO
WIPO	PCT/EP00/09755	4 OCTOBER 2000	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO
			<input type="checkbox"/> YES <input type="checkbox"/> NO
			<input type="checkbox"/> YES <input type="checkbox"/> NO
			<input type="checkbox"/> YES <input type="checkbox"/> NO

#### ALL FOREIGN APPLICATION(S), IF ANY FILED MORE THAN 12 MONTHS (6 MONTHS FOR DESIGN) PRIOR TO THIS U.S. APPLICATION

## POWER OF ATTORNEY

As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. (List name and registration number)

3  
Guido MODIANO (Reg. No. 19,928)

Albert JOSIF (Reg. No. 22,917)

Daniel J. O'BYRNE (Reg. No. 36,625)

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DIRECT TELEPHONE CALLS TO:  
(Name and telephone number)

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## DECLARATION

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

## SIGNATURE(S)

1-00  
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Full name of third joint inventor, if any \_\_\_\_\_  
 Inventor's signature \_\_\_\_\_  
 Date \_\_\_\_\_ Country of Citizenship \_\_\_\_\_  
 Residence \_\_\_\_\_  
 Post Office Address \_\_\_\_\_

**CHECK PROPER BOX(ES) IF ANY OF THE FOLLOWING ADDED PAGE(S) FORM A PART OF THIS DECLARATION**

- Signature for third and subsequent joint inventors. *Number of pages added* \_\_\_\_\_
- Signature by administrator(s), executor(s) or legal representative for deceased or incapacitated inventor. *Number of pages added* \_\_\_\_\_
- Signature for inventor who refuses to sign or cannot be reached by person authorized under 37 CFR 1.47. *Number of pages added* \_\_\_\_\_
- • •
- Added pages to combined declaration and power of attorney for divisional, continuation, or continuation-in-part (CIP) application.  
 *Number of pages added* \_\_\_\_\_

*If no further pages form a part of this Declaration then end this Declaration with this page and check the following item*

*This declaration ends with this page*